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Abstract

In this study, we examine whether or not the adoption of value-added tax (VAT) in developing countries is an effective way of stabilising tax revenues. Using a large panel of 103 developing countries observed over 1980-2008 and several alternative estimation methods in order to deal with the self-selection bias and the endogeneity issue inherent in VAT adoption, we found robust evidence that the presence of VAT leads to significantly lower tax revenue instability. On average, countries with VAT experience 40-50% less tax revenue instability than countries which do not have a VAT system. These effects decrease with the level of economic development and the openness of trade.

Keywords: Tax Instability, Value Added Tax, Macroeconomic Fluctuations, Developing Countries

JEL codes: H20, E32, O10.

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1. Introduction

Over the last 20 years, a large number of countries have implemented major tax reforms, mainly by adopting value-added tax (VAT). As a result, at the beginning of the 2010s, more than 130 countries worldwide had VAT, and among the developing countries, around 70% (104 out of 144) had adopted this kind of indirect taxation. VAT has tended to spread in regional bursts, in countries participating in International Monetary Fund (IMF) programmes and in countries with a low tax revenue performance in the past (Keen and Lockwood, 2010).

Several papers have assessed the gains associated with switching to VAT with regard to various outcomes. Gordon and Nielsen (1997) show that by relying more on VAT than on income tax, it is possible to decrease the real cost of evasion activities. After computing estimates of the marginal cost of public funds for five tax instruments in 36 African countries, Auriol and Warlters (2011) found that, on average within the sample, VAT was the tax instrument with the lowest marginal cost of funds. A large body of literature on tax-tariff reforms[1] has also established that a rise in domestic consumption taxes, most notably in VAT, in order to compensate for a decrease in import tariffs can improve welfare (Michael et al., 1993; Hatzipanayotou et al., 1994; Abe, 1995; Keen and Ligthart, 2002). However, Emran and Stiglitz (2005) questioned this result in the presence of a large informal sector, while Keen (2008) found that if both VAT and the practice of withholding taxes are deployed, tax-tariff reforms lead to a rise in welfare, even in the presence of a large informal sector. Finally, Keen and Lockwood (2010) found that the introduction of VAT has been globally associated with significantly more tax revenues being collected, even though its impact is modest in terms of size.

Beyond these identified consequences of reliance on a VAT system, one largely unexplored aspect is whether or not VAT also permits the stabilisation of tax revenues. From Table 1, we can see that, since the 1980s, developing countries have experienced much greater tax revenue instability than developed economies. Tax instability has decreased over time in developing countries but, in the 2000s, it remained significantly larger than in the OECD countries. The two regions of the world which exhibit the highest degree of tax instability are the Middle East and North Africa and the Sub-Saharan Africa.

[1] For a quantification of the relative marginal welfare costs of trade and commodity taxes, but not for VAT in particular, see also Clarete and Whaley (1987).

Table 1. Tax instability in OECD countries and developing countries

	1980's	1990's	2000's
OECD	1.093	0.920	1.002
Developing countries	2.379	2.369	1.891
East Asia and the Pacific	*2.397*	*2.297*	*1.823*
Europe and Central Asia	-	*2.937*	*1.766*
Latin America and Caribbean	*2.195*	*1.904*	*1.535*
Middle East and North Africa	*2.247*	*2.605*	*2.435*
South Asia	*2.224*	*1.717*	*1.206*
Sub-Saharan Africa	*2.473*	*2.564*	*2.099*

Note: Instability of the tax revenue ratio over GDP calculated as the standard deviation of the change in the variable over the decades.

The instability of tax revenues is of great concern, especially for developing countries, since it leads to volatility of much-needed public expenditures (Lim, 1983; Bleaney et al., 1995; Ebeke and Ehrhart, 2011). Bleaney et al. (1995) found that from the 1970s to the mid-1980s, the tax structure was an important factor in the stabilisation of revenues, with indirect domestic taxes producing a stabilising effect. Ebeke and Ehrhart (2011) confirmed this result for the period 1980-2005 for the case of Sub-Saharan African countries, and added that the stabilising effect had been reinforced since the mid-1990s. The aim of this paper is therefore to assess whether or not the adoption of a particular type of domestic indirect taxation, namely VAT, leads to the enhancement of the stability of tax revenues in developing countries. Using a panel of 103 countries over the period 1980-2008, we apply several estimation methods, controlling for endogeneity and self-selection issues, in order to generate robust results on the impact of the introduction of VAT on the stability of tax revenues.

To summarise our results, we found that VAT does indeed have a stabilising effect on the tax revenue ratio. Countries which have adopted the VAT system enjoy much more stable tax revenue than other countries. This effect is particularly important in low-income countries and in the context of low exposure to external shocks through open trade.

The paper is organised as follows. Section 2 presents the reasons why the adoption of VAT can have a stabilising effect. The estimation methodology is depicted in section 3 and section 4 reveals the results regarding the impact of VAT on tax revenue volatility. Finally, Section 5 concludes.

2. The stabilising effect of VAT

VAT is a "broad-based tax levied at multiple stages of production, with – crucially – taxes on inputs credited against taxes on output" (Ebrill et al., 2001, p. 3). This tax has been adopted in replacement of other sales taxes (either retail sales tax or turnover tax) and, according to its definition, the key advantage is that revenue is secured by being collected throughout the production process – unlike a retail sales tax (Cnossen, 2009) – but without cascading and distorting production decisions, unlike a turnover tax (Bird and Gendron, 2007). VAT is therefore less vulnerable to evasion than a retail sales tax, for which collection occurs during the final stage of production. However, Aizenman and Jinjarak (2008) emphasise that VAT collection efficiency remains largely dependent on the quality of enforcement and the efficiency of monitoring, which both increase with political stability and the ease and fluidity of political participation. Moreover, increased expenditure on the administration of VAT and more experience with VAT have been found to be significantly associated with increased compliance (Agha and Haughton, 1996). Fortunately, the adoption of VAT is generally part of wider tax system reforms, aiming to improve tax administration and compliance.

Two main reasons can be postulated as to why the adoption and the presence of VAT in a country can lead to enhanced tax stability.

The first reason derives from the fact that VAT can generate more stable revenues than the retail sales tax that it often replaces. Indeed, as emphasised above, VAT is collected throughout the entire value-added chain, and so if one part of this chain is hit by an idiosyncratic shock, the tax revenues collected from the remaining parts of the value-added chain may still be secured. Therefore, the collection of VAT revenues at numerous stages of the value-added chain can diversify the risk and render tax revenues less sensitive to shocks, and thus more stable, than in a situation in which consumption taxes are collected only at the final retail stage.

Second, the adoption of VAT has been found to be associated with a rise in the level of tax being collected (Keen and Lockwood, 2010), with the relative shares of tax revenue originating from tariffs and income taxes respectively therefore being reduced. This idea is reinforced by the fact that VAT implementation often occurs in the context of trade liberalisation, in an attempt to recover lost revenues from tariffs from domestic sources

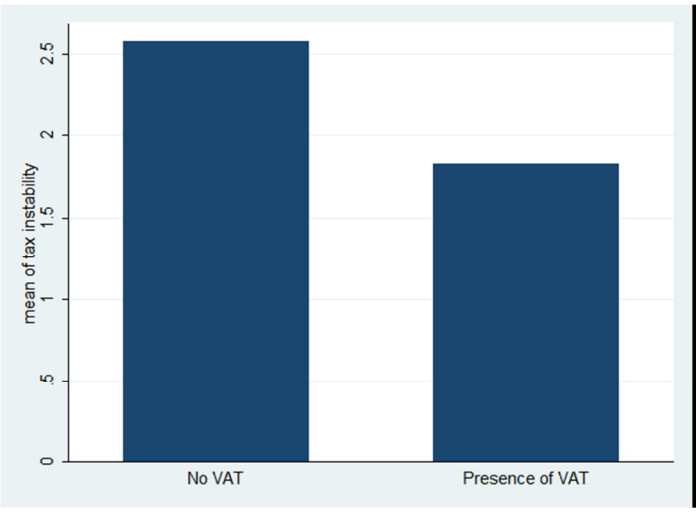
(Keen, 2009; Baunsgaard and Keen, 2010). The presumption is that, since VAT relies mainly on final consumption[2] and this component is relatively more stable than exports, imports or companies' profits, a greater reliance on VAT revenues for tax mobilisation (rather than on income taxes or import duties) is expected to stabilise tax revenues (Bleaney et al., 1995; Ebeke and Ehrhart, 2011).

3. Estimation method

3.1.Data and methodology

Our dataset consists of 103 developing countries observed over the period 1980-2008 (see Appendix 1). According to Figure 1, preliminary evidence shows that the average level of tax instability in countries without VAT is significantly larger than in countries that have adopted VAT.

Figure 1: Tax revenue instability in countries with and without a VAT



Source: authors' calculations

[2] Even though, on average, around 55% of VAT is collected at borders on imports (Ebrill et al., 2001), the remaining 45% relies on domestic consumption and is therefore more likely to be stable.

In order to assess the effect of the adoption of VAT on the instability of government revenues, the estimated econometric model is as follows:

$$\log(\sigma_{i,t}) = \alpha + \beta_1 VAT_{i,t} + \beta_2 X'_{i,t} + u_i + \lambda_t + \varepsilon_{i,t}$$

where *i* and *t* are indicators of the country and year, respectively and $\sigma_{i,t}$, the instability of the tax revenue to GDP ratio, is the dependent variable.[3] The use of the standard deviation to measure instability is widely supported in the literature. However, as highlighted by Nelson and Plosser (1982), macroeconomic data are integrated of order 1, and so we apply the first-difference operator to these data in order to ensure that they are stationary before measuring the standard deviation. Hence, our measure of instability is the standard deviation of the change in the variable over five-year non-overlapping sub-periods, as in Bleaney et al. (1995) and Combes and Ebeke (2011). $VAT_{i,t}$ is a dummy for the presence of VAT and equals 1 when VAT is present for at least three years inside the five-year sub-period. The six sub-periods are 1980-1984; 1985-1989; 1990-1994; 1995-1999; 2000-2004 and 2005-2008. The vector $X'_{i,t}$ captures other explanatory variables, which are discussed in greater detail below, which affect the instability of tax revenues. The terms u_i and λ_t are country-specific and time-specific effects, respectively, and $\varepsilon_{i,t}$ is an unobserved random error term.

The matrix of control variables includes the standard determinants of tax revenue instability (see Lim, 1983; Bleaney et al., 1995; Ebeke and Ehrhart, 2011). Among the structural factors are GDP per capita, trade openness and the level of natural resource rent. The level of economic development (GDP per capita) would be negatively associated with the instability of taxes, because it is a proxy for the degree of risk management and the diversification of production activities, which can lower the degree of volatility. The contribution of trade openness to tax instability is less striking. On the one hand, trade openness may act as a proxy for an openness policy, behind which exists a willingness to provide better management of economic affairs, as well as good institutions and policies for competitiveness. On the other hand, trade openness may be a proxy for the "natural openness" which increases the vulnerability of a small open economy to external shocks. Overall, the sign of the coefficient of the trade openness variable (exports plus imports divided by the GDP) is ambiguous. We expect to find a positive association between the levels of natural resource rent and tax revenue instability, because the price of natural resources is known to be

[3] By using a log-linear specification, we ensured that the fitted values for $\sigma_{i,t}$ were strictly positive and we can directly interpret the estimated parameters as semi-elasticities.

highly volatile. The other determinants are the instability of GDP per capita, inflation instability, the level of inflation and the presence of elections. We expect all of these variables to be associated with increased tax revenue instability. Data for government revenues, excluding grants, are drawn from IMF's Government Finance Statistics and completed using Article IV data. The dummy executive election variable is taken from the Database of Political Institutions and all other variables are taken from the World Bank's World Development Indicators.

3.2.Endogeneity and self-selection issues

The OLS estimator does not take into account the fact that the presence of VAT is not assigned to countries at random. In fact, a country could choose to adopt this taxation system in order to enhance its tax collection and also to enjoy more stable revenues through the taxation of a specific component of the tax base (here, private consumption) which is more stable than the other components of the tax base. Therefore, in order to ensure that the estimated effect is the correct one, it is necessary to deal with the self-selection bias, which is another reason that an explanatory variable, namely the VAT dummy, may be endogenous (Wooldridge, 2002).

In order to correct for this endogeneity bias, we resorted to an instrumental variables technique. As external instruments for the adoption of VAT, we use the lagged percentage of geographical neighbours that have already adopted VAT and the lagged value of the level of the tax revenue ratio, which are two variables that Keen and Lockwood (2010) found to be significant determinants of VAT adoption. The first instrument is expected to be positively correlated with the presence of VAT because of neighbourhood imitation effects but should not have any direct impact on the instability of tax revenues. The second instrument is used to capture the idea that countries with initially lower tax revenue performances receive higher marginal benefits from the adoption of VAT. We rely on the 2SLS estimator, as using a linear regression for the first-stage estimates generates consistent second-stage estimates, even with a dummy endogenous variable (Angrist and Krueger, 2001). However, given that VAT is a dummy variable, we also employ, as a robustness test, an estimation method which uses a probit model in the first stage, rather than a linear regression model.[4]

[4] We use the routine *treatreg* in StataCorp which is suited to binary endogenous regressors (see Cameron and Trivedi, 2009).

4. Results

4.1.The impact of VAT on tax revenue instability

The results with the instrumental variable estimators are presented in Table 2. The first-stage estimations with the 2SLS estimator are displayed in columns 5 and 6, while the results of the corresponding second-stage estimations are shown in columns 1 and 2. The results of the first-stage estimations of VAT adoption (columns 5 and 6) indicate that the external instruments (the lagged share of neighbours with VAT and the lagged level of tax revenues) are statistically significant and the F-test statistics are above 10, indicating the strength of our two instruments. In column 1, the results highlight a negative and significant effect of the presence of VAT on tax revenue volatility. We do not reject the null hypothesis of the Hansen test, which means that our instruments are valid. In the second column, with some additional control variables, the effect of VAT remains significantly negative at the 5% level, indicating that VAT reduces tax revenue instability. When taking into account the fact that our endogeneous variable of interest is a dummy, we obtain the results presented in column 3. The first-stage probit model of VAT adoption is displayed in column 7. The negative impact of VAT on tax revenue instability holds and is significant at the 1% level.

In column 4, we consider the possibility that tax revenue instability may be persistent. The lagged level of the dependent variable is therefore included in order to discern any persistency which might characterise the dynamics of tax revenue instability. The IV-FE estimator becomes inconsistent because the lagged level of tax instability is correlated with the error term due to the presence of country fixed effects (Nickell, 1981). One way to handle these issues is to use the generalised method of moments (GMM; Blundell and Bond, 1998). The system-GMM estimator combines, within a system, first-difference equations, where the right-hand-side variables are instrumented by lagged levels of the series with an additional set of equations in levels, using the lagged first differences of the series as instruments. We use our two external instruments (lagged share of neighbours with VAT and lagged tax revenues) for the dummy VAT. The first- and second-order autocorrelation tests of the residuals in the first difference (AR(1) and AR(2) tests) and the Hansen test confirm the validity of our estimation with the two external instruments. The results remain unchanged: the presence of VAT leads to more stable tax revenues. The average effect stands at exp(-0.658) = 0.52; therefore, countries with a VAT system experience approximately 48% less tax instability than countries without VAT.

Table 2. The effect of VAT on tax revenue instability - Instrumental variable techniques

	Tax Instability (log)				VAT adoption *First Stage*		
	2SLS	2SLS	Treatreg	IV GMM-System			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy VAT	-1.007**	-0.978**	-0.916***	-0.658**			
	(0.503)	(0.494)	(0.219)	(0.335)			
Log Tax instability (lag)				0.245***			
				(0.086)			
GDP pc (log)	-0.009	-0.0004	0.136**	0.150	0.134	0.137	0.714***
	(0.283)	(0.284)	(0.058)	(0.096)	(0.123)	(0.123)	(0.124)
Instability GDP pc (log)	0.0642	0.0631	0.105**	0.0982*	0.00004	-0.0004	-0.0834
	(0.059)	(0.058)	(0.048)	(0.052)	(0.028)	(0.028)	(0.100)
Inflation (log)	0.452**	0.463**	0.236	0.169	0.130	0.133*	-0.413
	(0.182)	(0.183)	(0.197)	(0.155)	(0.073)	(0.074)	(0.440)
Inflation instability (log)	0.0227	0.0202	0.0818*	0.0544	0.00285	0.0023	0.0821
	(0.045)	(0.045)	(0.045)	(0.045)	(0.213)	(0.021)	(0.099)
Openness (log)	0.169	0.0647	0.281***	0.176*	0.0655	0.0488	-0.479**
	(0.226)	(0.232)	(0.078)	(0.092)	(0.104)	(0.11)	(0.189)
Oil rent (log)		0.148	0.166***	0.117**		0.0326	-0.172**
		(0.124)	(0.037)	(0.050)		(0.060)	(0.077)
Executive Elections		0.0942	0.105	0.0708		-0.00095	0.455***
		(0.088)	(0.084)	(0.079)		(0.051)	(0.166)
Lagged Presence of VAT in the region					0.0081***	0.0081***	0.0172***
					(0.002)	(0.002)	(0.006)
Lagged Tax Revenue					-0.0099*	-0.0103*	-0.0472***
					(0.005)	(0.006)	(0.013)
Observations	377	377	389	367	377	377	389
Number of countries	103	103	103	99	103	103	103
Hansen Test (p-value)	0.658	0.823		0.309			
F-Test instruments					10.35	10.12	
Nb of instruments				23			
AR(1) test (p-val)				0.000			
AR(2) test (p-val)				0.353			

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. A constant and time and country fixed effects are included in all estimations. In the GMM-system estimation, the one-step estimator is used with robust standard errors. Elections, inflation, inflation instability, oil rent and GDP instability are considered as exogenous. The lagged dependent variable and the level of GDP per capita are instrumented with first-order to fourth-order lagged values. We include the lagged presence of VAT in the region and the lagged tax revenue as external instrument for the adoption of VAT. The matrix of instruments has been collapsed.

The results in Table 2 also highlight the fact that the presence of VAT is not the only significant determinant of the volatility of government tax revenues. Indeed, it appears that an unstable macroeconomic environment (high inflation and growth volatility) fuels the volatility of tax revenues, a result which is consistent with previous studies (Lim, 1983; Bleaney et al., 1995; Ebeke and Ehrhart, 2011).

Regardless of the instrumental variable estimator used, the results confirm the main hypothesis presented in this paper, namely that countries which have adopted a VAT system enjoy much more stable tax revenues than countries which have not.

4.2.Accounting for heterogeneity in the impact

Having established a robust stabilising impact of the presence of VAT on the tax revenue ratio, this paper extends the analysis by testing for the existence of heterogeneous effects of VAT. We argue that some countries are better equipped to enjoy the stabilising effect of VAT than others. This paper follows Keen and Lockwood (2010) in terms of the choice of conditional variables. Indeed, these authors found that VAT is more likely to increase the total tax revenue ratio as the levels of per capita income and trade openness increase. Therefore, our paper extends this analysis by testing the effect of these two variables (per capita GDP and trade openness) on the sensitivity of the instability of tax revenues with regard to the presence of VAT.

The previous econometric model is modified slightly in order to allow an interactive term of the dummy VAT to be crossed with each of the two conditional variables while controlling additively for each component of the interactive term. Keen and Lockwood (2010) argued that VAT is more likely to increase tax revenues in countries with relatively high levels of GDP per capita and trade openness for the following two reasons. First, countries with a higher income cope more easily with the distinct administrative and compliance requirements of VAT. Second, VAT collections at borders typically account for a large part of the total VAT revenues in most developing countries. All else being equal, one would therefore expect VAT to function better in more open economies, since the tax base is more readily accessible. How does this translate into the analysis of tax revenue stability? Are the effects found by Keen and Lockwood (2010) regarding the impact of the levels of economic development and trade openness on the relationship between the level of tax revenues and the presence of VAT similar to those that can be estimated in the case of the stability of the tax revenue ratio?

This paper hypothesises that the effect of the levels of economic development and trade openness on the strength of the negative relationship between VAT and the instability of tax revenues is unclear regarding the level of economic development, but clearer regarding the trade openness variable. On the one hand, one could argue that the implementation of VAT is less difficult for countries which have already attained a relatively high level of economic

development, and that they can therefore better enjoy the stabilising properties of this taxation instrument. On the other hand, the marginal benefits in terms of tax revenue stability of having VAT may be higher in low-income countries because they are less diversified and suffer most from high levels of output volatility (Koren and Tenreyro, 2007). Therefore, reliance upon VAT in these countries could help to overcome the strong macroeconomic instability of the environment by taxing an aggregate which represents a high proportion of domestic wealth and, at the same time, is among the more stable aggregates.

Regarding the role of the trade openness variable, one would expect the presence of VAT to have a marginal stabilising effect which would decrease with the degree of trade openness. Based on the finding that trade openness is a source of macroeconomic volatility in developing countries (di Giovanni and Levchenko, 2009), one could expect that a VAT system (which is less dependent upon the external sector) would help to stabilise tax revenues.

The results of econometric investigations are presented in Table 3. Due to the strong inertia which characterises the tax revenue instability variable, the econometric model includes the lagged dependent variable and is estimated using the system-GMM estimator. Column 1 adds an interactive term of VAT crossed with GDP per capita. The results indicate a significant and positive sign of the coefficient associated with the interactive variable while the coefficient of the VAT dummy exhibits a significantly negative sign. This means that the stabilising effect of VAT decreases with the level of development. Based on the two coefficients associated with the VAT dummy, we computed the GDP threshold beyond which the stabilising effect of VAT disappears. It stands at $8,224 US, which corresponds to the category of upper-middle-income countries ($3,976 to $12,275 US), according to the World Bank's income classification. This result highlights the fact that VAT helps to reduce the volatility of public tax revenues, especially amongst the low-income and lower-middle-income countries.

In column 2, the results suggest a marginal stabilising effect of VAT which decreases with the degree of trade openness. Indeed, the coefficient of the additive term of the VAT dummy is negative, whereas that which corresponds to the interactive term exhibits a positive sign. This result highlights the fact that the benefit of VAT in terms of tax revenue stability is higher when the level of trade openness is lower. However, the relatively high value of the estimated trade openness threshold suggests that in our sample, the bulk of countries are all located in the stabilising area of the effect of VAT.

Table 3. Heterogeneous impact of the VAT

	Tax instability (log) *GMM-System*	
VARIABLES	(1)	(2)
Dummy VAT	-3.651***	-2.095**
	(1.411)	(0.891)
VAT x GDP pc (log)	0.405**	
	(0.185)	
VAT x Lagged Openness (log)		0.386*
		(0.206)
Lagged tax instability (log)	0.261***	0.205**
	(0.0893)	(0.0848)
GDP pc (log)	-0.242	0.144
	(0.158)	(0.111)
GDP pc instability (log)	0.0898*	0.0897*
	(0.0532)	(0.0502)
Inflation (log)	0.211	0.212
	(0.166)	(0.172)
Inflation instability (log)	0.0174	0.0474
	(0.0459)	(0.0462)
Oil rent (log)	0.172***	0.138***
	(0.0521)	(0.0517)
Openness (log)	0.308***	
	(0.0971)	
Lagged Openness (log)		0.0803
		(0.138)
Executive Elections	0.0694	0.0723
	(0.0823)	(0.0757)
Observations	367	366
Number of countries	99	99
Joint significance of VAT coefficients: p-value	0.014	0.046
Threshold of the conditional variable	$8,224USD	228%
Number of instruments	25	25
Hansen Test (p-val)	0.210	0.546
AR1 Test (p-val)	0.000	0.000
AR2 Test (p-val)	0.322	0.585

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. A constant and time and country fixed effects are included in all estimations. The one-step system-GMM is used. Elections, inflation, inflation instability, oil rent and GDP instability are considered as exogenous. The lagged dependent variable and the level of GDP per capita are instrumented with first-order to fourth-order lagged values. The dummy VAT and the dummy VAT crossed by each conditional variable (GDP and openness) are instrumented by external instruments lagged vat, lagged tax rev and their interactive terms with each of the conditional instruments. The matrix of instruments has been collapsed.

These two results contrast with those of Keen and Lockwood (2010), who analysed the conditional impact of VAT on the level of the tax revenue ratio. Our paper shows that the level of economic development and the degree of trade openness reduce the marginal effectiveness of VAT in terms of tax revenue stabilisation, while Keen and Lockwood (2010) found that these factors increase the effectiveness of VAT in terms of revenue mobilisation.

5. Conclusion

In this paper, we investigated whether the large wave of VAT adoption in developing countries over the last 20 years has permitted the stabilisation of their tax revenues. Using several alternative estimation methods in order to deal with the self-selection bias and the endogeneity issues inherent in VAT adoption, we found robust evidence that the presence of VAT leads to an enhancement in the stability of tax revenues. On average, countries with VAT experience 40-50% less tax revenue instability than countries without VAT. We established that this effect is stronger in low-income countries and in the context of low exposure to external shocks as a result of trade openness.

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7. Appendices

Appendix 1 – List of 103 countries in the sample (Year of VAT adoption)

Afghanistan, Albania (1996), Algeria (1992), Angola, Argentina (1975), Armenia (1992), Azerbaijan (1992), Bangladesh (1991), Belarus (1992), Belize (2006), Benin (1991), Bhutan, Bolivia (1973), Botswana (2002), Brazil (1967), Bulgaria (1994), Burkina Faso (1993), Burundi, Cambodia (1999), Cameroon (1999), Cape Verde (2004), Central African Republic (2001), Chad (2000), China (1994), Colombia (1975), Democratic Republic of Congo, Republic of Congo (1997), Costa Rica (1975), Cote d'Ivoire (1960), Djibouti, Dominican Republic (1983), Ecuador (1970), Egypt (1991), El Salvador (1992), Ethiopia (2003), Fiji (1992), Gabon (1995), The Gambia, Georgia (1992), Ghana (1998), Guatemala (1983), Guinea-Bissau, Haiti (1982), Honduras (1976), India (2005), Indonesia (1985), Islamic Rep.of Iran, Jamaica (1991), Jordan (1994), Kazakhstan (1992), Kenya (1990), Kyrgyz Republic (1992), Lao PDR (2004), Lesotho (2003), Liberia, Lithuania (1994), Madagascar (1994), Malawi (1989), Maldives, Malaysia, Mali (1991), Mauritania (1995), Mauritius (1998), Mexico (1980), Moldova (1992), Mongolia (1998), Morocco (1986), Mozambique (1999), Namibia (2000), Nepal (1997), Nicaragua (1975), Niger (1986), Nigeria (1994), Pakistan (1990), Panama (1977), Papua New Guinea (1999), Paraguay (1993), Peru (1973), Philippines (1988), Romania (1993), Rwanda (2001), Samoa (1994), Senegal (1980), South Africa (1991), Sri Lanka (1998), Sudan (2000), Swaziland, Syrian Arab Republic, Tajikistan (1986), Tanzania (1998), Thailand (1992), Togo (1995), Tunisia (1988), Turkey (1985), Uganda (1996), Ukraine (1992), Uruguay (1968), Vanuatu (1998), Venezuela (1993), Vietnam (1999), Yemen (2005), Zambia (1995), Zimbabwe (2004).

Appendix 2 - Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Tax instability (log)	389	0.449	0.808	-1.721	2.561
Dummy VAT	389	0.622	0.485	0	1
GDP per capita (log)	389	7.752	0.958	5.395	9.680
GDP per capita volatility	389	0.808	0.821	-1.300	3.406
Inflation (log)	389	4.769	0.327	4.574	7.799
Inflation instability (log)	389	1.673	1.509	-1.259	9.190
Oil rent (log)	389	0.752	1.163	0	4.301
Openness (log)	389	4.170	0.527	2.644	5.337
Elections	389	0.578	0.494	0	1
Lagged share of the presence of VAT in the region	389	35.006	24.712	0	82.857
Lagged tax revenue	389	18.715	7.784	2.870	53.10